340100

JPRS 84566

19 October 1983

West Europe Report

SCIENCE AND TECHNOLOGY

No. 159

DFVLR DOCUMENTS 1983 BUDGET, MAIN AREAS OF RESEARCH

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 84566

19 October 1983

WEST EUROPE REPORT

SCIENCE AND TECHNOLOGY

No. 159

CONTENTS

DFVLR Documents 1983 Budget, Main Areas of Research
(Ernst Doell, Editor; PROGRAMMBUDGET 1983, Dec 83) 1

Explanatory Notes
Medium-Term Development of Research Main Points, 1981-1986
DFVLR Organizational Chart--As of December 1982
Main Point 1. Air Traffic Control--V
Main Point 2. Aircraft--L
Main Point 3. Turbo Propulsion and Fluid-Mechanics Engines--A
Main Point 4. Non-Nuclear Energy Systems--S
Main Point 5. Satellite Communications and Location--K
Main Point 6. Earth Observation-E
Main Point 7. Space Systems--R
Main Point 8. New Technologies, Technology Transfer--T
Supplementary Data; DFVLR Budget as Part of Federal Budget
DFVLR Research and Service Installations--As of December 1982
DFVLR Infrastructure

 [III - WE - 151 S&T]

SCIENCE POLICY

DFVLR DOCUMENTS 1983 BUDGET, MAIN AREAS OF RESEARCH

Muelheim a.d. Ruhr PROGRAMMBUDGET 1983 in German Dec 82 pp IX to 10-5

[Report edited by Ernst Doell for the German Aerospace Research and Testing Institute: "Program Budget for 1983"]
[p IX]
[Excerpts] Explanatory Notes

The personnel figures given for 1982 and the years thereafter correspond to the current state of planning; this causes partial deviations from the corresponding figures in 1982 program budget.

The capacity data (costs and personnel) for 1983 correspond to the latest economic planning version (status as of 1 September 1982).

The personnel capacities given for the programs encompass the personnel shown in the job manning plan as well as the additional personnel who are employed without using the job manning plan (project item personnel). However, the statistics only show the capacity share directly to be allocated to the R&D projects. To that we must add the capacities for the operation of the big scientific-technical installations and the research and service installation capacities used directly for research and development as well as the capacities of the infrastructure facilities of the DFVLR [German Research and Experimental Institute for Air and Space Travel] (administration and general services, management and staff). The costs given for the individual programs are the (rounded) projected full costs for the execution of the tasks described. Consideration was given here to the presumed rate schedule hikes (1982, 3.6 percent and 1983, 3.5 percent).

The breakdown of DFVLR work into main points, programs, and undertakings in terms of their system does not directly correspond to the federal government research and technology programs assembled according to other viewpoints. The table on page 10-1 [of original, see below] therefore shows to what extent the DFVLR programs are making a contribution to the federal government's promotion sectors and which cost shares can be matched up for these purposes by way of a rough estimate.

These costs were used as basis for a conversion to the various allocations. To the extent that non-R&D-related costs, depreciations, investments, as well as earnings and project promotion could not be matched up with the promotion sectors, this was done through percentage-wise apportionment.

[p X]

Medium-Term Development of Research Main Points, 1981-1986

Key: 1--Total costs in millions of DM; 2--Study program; 3--Air traffic control; 4--Aircraft; 5--Turbo propulsion and aerodynamic engines; 6--Non-nuclear energy systems; 7--Satellite communications and location; 8--Ground observation; 9--Space travel systems; 10--New technologies, technology transfer; 11--Project operator positions; 12--R&D program costs; 13--Non-R&D related costs; 14--DFVLR total costs; 15--Personnel capacity in man-years; 16--Capacity directly employed for R&D; 17--Operation of scientific-technical installations; 18--Capacity of research and service installations employed indirectly for R&D; 19--Technical enterprises; 20--Available capacity of research and service installations; 21--Promotion of post-graduate advanced training; 22--DFVLR infrastructure; 23--Available capacity of DFVLR; 24--Capacity not available due to partly unfilled slots; 25--DFVLR total slots (*); Ist--Actual; Soll--required; (*)The total slots include the earning-financed project slots as well as slots for the young scientist recruiting program; these slots are given in parentheses; this does not include guest researchers, trainees, fee recipients, and scientific assistants.

[Table on following page]

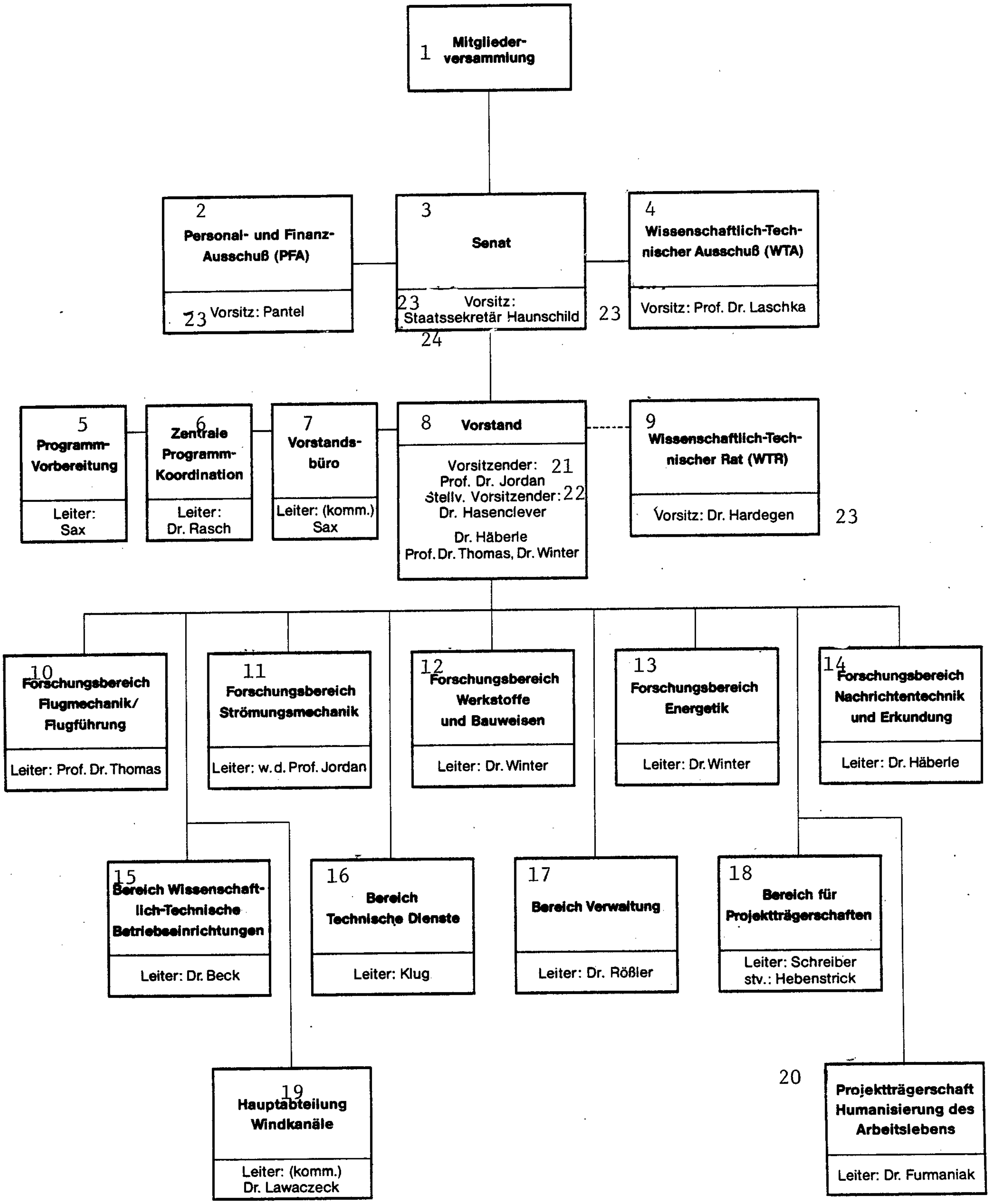
[See title and key on preceding page]

	Gesamtkosten in Mio DM	Ist 1981	Soll 1982	**Soll 1983**	Soll 1984	Soll 1985	Soll 1986
1	**Gesamtkosten in Mio DM**						
2	Studienprogramm	2,9	4,4	**5,6**	5,9	6,3	6,8
3	Luftverkehrsführung	18,4	24,8	**22,4**	24,1	25,2	27,0
4	Luftfahrzeuge	74,8	79,1	**79,8**	85,6	90,9	97,3
5	Turboantriebe und Strömungsmaschinen	31,6	29,4	**29,3**	31,4	33,1	35,2
6	Nichtnukleare Energiesysteme	14,1	21,4	**22,5**	23,7	24,7	26,6
7	Satellitenkommunikation und -ortung	7,6	9,0	**9,1**	9,8	10,3	11,1
8	Erdbeobachtung	32,9	36,7	**36,2**	38,9	40,8	43,7
9	Raumfahrtsysteme	58,8	64,1	**67,1**	67,8	70,9	75,9
10	Neue Technologien, Technologietransfer	12,7	19,4	**26,3**	28,7	31,4	33,5
11	Projektträgerschaften	33,9	29,6	**30,4**	32,5	33,4	35,8
12	Kosten des FE-Programms	287,7	317,9	**328,7**	348,4	367,0	392,9
13	Nicht-FE-bezogene Kosten	40,7	40,4	**40,4**	42,0	43,6	45,3
14	Gesamtkosten DFVLR	328,4	358,3	**369,1**	390,4	410,6	438,2

	Personalkapazität in Mannjahren	Ist 1981	Soll 1982	**Soll 1983**	Soll 1984	Soll 1985	Soll 1986
15	**Personalkapazität in Mannjahren**						
2	Studienprogramm	21	25	**35**	35	35	35
3	Luftverkehrsführung	137	145	**127**	127	125	125
4	Luftfahrzeuge	424	427	**427**	427	425	425
5	Turboantriebe und Strömungsmaschinen	202	188	**186**	186	184	184
6	Nichtnukleare Energiesysteme	93	127	**130**	130	126	126
7	Satellitenkommunikation und -ortung	57	69	**69**	69	68	68
8	Erdbeobachtung	188	182	**178**	178	175	175
9	Raumfahrtsysteme	243	229	**224**	224	220	220
10	Neue Technologien, Technologietransfer	87	117	**160**	160	164	164
11	Projektträgerschaften	272	290	**281**	280	280	280
16	Unmittelbar in FE eingesetzte Kapazität	1 724	1 799	**1 817**	1 816	1 802	1 802
17	Betrieb von Wissenschaftlich-Technischen Anlagen	279	302	**302**	300	290	290
18	Mittelbar für FE eingesetzte Kapazität der Forschungs- und Dienstleistungseinrichtungen	333	294	**289**	290	290	290
19	Technische Betriebe	450	458	**450**	442	435	435
20	Verfügbare Kapazität der Forschungs- und Dienstleistungseinrichtungen	2 786	2 853	**2 858**	2 848	2 817	2 817
21	Förderung der nachuniversitären Weiterbildung	–	30	**30**	60	90	90
22	Infrastruktur der DFVLR	573	564	**553**	544	536	536
23	Verfügbare Kapazität der DFVLR	3 359	3 447	**3 441**	3 452	3 443	3 443
24	Durch teilweise nicht besetzte Stellen nicht verfügbare Kapazität	54	–	**–**	–	–	–
25	Gesamtstellen der DFVLR *)	3 413 (329)	3 447 (465)	**3 441 (613)**	3 452 (668)	3 443 (708)	3 443 (708)

[p XIII]

DFVLR Organizational Chart--As of December 1982
[See key on following page]



[See chart on preceding page]

Key: 1--Membership assembly; 2--Personnel and finance committee (PFA); 3--Senate; 4--Scientific-technical committee (WTA); 5--Program preparation; 6--Central program coordination; 7--Board of directors office; 8--Board of directors; 9--Scientific-technical council (WTR); 10--Flight mechanics, flight control research area; 11--Mechanics of fluids research area; 12--Raw material and construction method research area; 13--Energy research area; 14--Communications technology and exploration research sector; 15--Scientific-technical plant installation area; 16--Technical services area; 17--Administration area; 18--Project operator position area; 19--Main division for wind tunnels; 20--Job life humanization project operator position; 21--Chairman; 22--Deputy chairman; 23--Chair; 24--State secretary; Leiter--Chief; Leiter (komm.)--Acting chief; stv.--Deputy.

[pp 1-1--1-6]

Main Point 1. Air Traffic Control--V

	1981	1982	1983	1984	1985	1986
1	18,4	24,8	22,4	24,1	25,2	27,0
2	137	145	127	127	125	125

Key: 1--Costs (millions of DM); 2--Personnel (man-years).

The growing requirements for air traffic safety, economy, and reliability as well as environmental protection measures call for constant improvements in methods and equipment used for air traffic control. Through the development of components and systems of greater accuracy and reliability for navigation and aircraft control in combination with improved communication between the aircraft and the ground we create the prerequisites for the introduction of automated flight path control and at the same time, aircraft pilots and ship pilots are relieved of routine operations. Investigations are being carried out in close cooperation or coordination with government authorities, such as the BFS [Federal Flight Safety Institute], LBA [Federal Aviation Bureau], and the BWB [Federal Defense Equipment and Procurement Bureau], as well as industry.

Flight safety is supported especially by work in the field of man-machine relationships, pilot stress, error diagnosis by means of on-board-integrated flight data systems, as well as conclusions from accident studies.

Research tasks carried out within this main point are guided by the "Overall Aviation Research and Aviation Technology Program" of the federal government, specifically by the subgoals "Requirement and Mission Analyses," "Operation Improvements," "Improvement of Man-Machine Relationship."

The study activities on air traffic control systems of the future, which so far have been placed under this main point in the "Traffic Control and Communications Systems of the Future" Program, are combined as of 1983 with the corresponding activities under the other main points within a common "ST Study Program" (see page 0-1 [of original]). This is also where the studies in the transportation science sector, which are so far contained in the "Long-Distance Transportation Systems" Program for the technical support of the ministries, are shown.

Program: Flight Safety and Man-Machine Systems--VSI

	1981	1982	1983	1984	1985	1986
1	3,3	5,3	5,2	5,6	5,9	6,3
2	26	29	29	29	29	29

Key: 1--Costs (millions of DM); 2--Personnel (man-years).

Program: Technology and Structure of Future Flight Control Systems--VTF

	1981	1982	1983	1984	1985	1986
1	5,5	6,4	6,5	7,0	7,3	7,8
2	31	26	26	26	26	26

Key: 1--Costs (millions of DM); 2--Personnel (man-years).

Content and Objective

The program comprises basic technological work on flight control, including research, development of fundamentals, and testing in the following fields:

Sensors,

Navigation systems,

Testing systems for control components.

The following are the medium-term subgoals:

Development and investigation of inertial navigation sensors and systems, especially optical gyros and laser gyro navigation systems;

Use of strapdown systems for navigation and stabilization;

Development and investigation of novel navigation components according to the altitude and image correlation method;

Testing and use of support sensors--for example, GPS [Global Positioning System], correlation methods--for precision navigation;

Further development of hybrid flight survey systems using a INS [Inertial Navigation System] and laser radar set for highly-precise on-line path surveying;

Continuing buildup of systems for the testing of ESM and ECM instruments.

Current Situation

The buildup of a modular ring laser system to reduce the cost and to simplify this essential laser gyro component is now in progress. The DFVLR concept for a highly-accurate laser-gyro was taken over by industry (Honeywell/Zeiss) within the context of the BWB development contract entitled "Laser Gyro--Aircraft"; the project is currently on schedule. Measurement instruments for the highly-precise measurement of laser reflectors (back-scatter, reflectivity) were sold to industry. A laboratory laser gyro with mechanical lock-in compensation (<1°/h drift) is available; the investigation of magneto-optical components is being continued.

Experimental modular strapdown system (MOSY) based on floating gyros has been tested in the laboratory and in flight. Dry gyros have been tested in the laboratory. Concept for use of strapdown systems for navigation and stabilization has been prepared. Derived from MOSY, we got the concept for "Model Attitude Measurement System (MAMS)" whose development was accomplished together with industry; passed on to the DNW [German-Dutch wind tunnel] during the first development stage.

Navigation and various altitude correlation methods were tested in flight.

Improvement of image correlation methods is in progress.

A precision navigation method for routine checking on SETAC ground stations by the flight survey squadron of the BFS and the West German Armed Forces--developed according to the DFVLR concept--was flight-tested.

First development stage of the new hybrid flight survey system, consisting essentially of the inertial platform (Carousel IV) and laser radar, was tested successfully; the determination of the error performance of the inertial navigation system played a special role here.

Hybrid systems for the surveying of control components and parameters (on-board antennas, radar cross-section) were improved and employed successfully. Initial survey measurements of ESM and ECM systems in flight were carried out.

Implementation, Delimitation, Cooperation

The requiring clients are as follows: BMVg [Federal Defense Ministry], BWB, BFS, LBA, as well as as MBB [Messerschmidt-Boelkow-Blohm], Dornier.

There is cooperation with the following: Honeywell, Zeiss, SEL, NLR [National Air and Space Laboratory], DNW.

Scientific contacts exist with the following: Testing stations 61 and 91, FhG [Fraunhofer Society], NLR, PTB [Federal Physical-Technical Institute], Royal Radar Establishment, Braunschweig Technical University, Hamburg-Harburg Technical University, Philips Research Laboratory in Hamburg, Bochum WBK [Housing Construction Combine], MPI [Max Planck Institute] for Quantum Optics.

Program: Navigation and Flight Safety in Case of High Air Traffic Density--V NFS

	1981	1982	1983	1984	1985	1986
1	2,6	4,0	3,9	4,2	4,4	4,7
2	19	22	22	22	20	20

Key: 1--Costs (millions of DM); 2--Personnel (man-years).

Project: DFVLR Flight Experiment Operator (ATTAS [Advanced Technological Testing Aircraft System]--V PA

	1981	1982	1983	1984	1985	1986
1	1,5	3,1	**3,1**	3,3	3,5	3,8
2	12	20	**20**	20	20	20

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Projects Support: Air Traffic Project--VP

	1981	1982	1983	1984	1985	1986
1	5,5	6,0	**3,7**	4,0	4,1	4,4
2	49	48	**30**	30	30	30

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

[pp 2-1--2-12]

Main Point 2. Aircraft--L

	1981	1982	1983	1984	1985	1986
1	74,8	79,1	**79,8**	85,6	90,9	97,3
2	424	427	**427**	427	425	425

Key; 1--Costs (in millions of DM); 2--Personnel (man-years).

The development on the aircraft market, which is exposed to keen international competition, is marked by the situation on the energy and raw material market, rising pressure from costs in the procurement and maintenance of increasingly complex instruments as well as the requirement for greater effectiveness in weapon systems. Some of the central tasks here include more high-performance design methods, lower-resistance and lighter configurations, increased maneuverability, precise path control, and early damage detection. The following above all contribute to the accomplishment of these tasks: New methods of system-integrating design, improved methods for aerodynamic design, the use of advanced raw materials and construction methods for the airframe, as well as the introduction of active control techniques and precise guidance methods.

Research work is extensively guided by the federal government's "Overall Program for Aviation Research and Aviation Technology." The studies are to a great extent carried out in close cooperation with industry; this among other things is expressed by cooperation in the ZKP (Civilian Component Program) of the BMFT [Federal Ministry of Research and Technology] as well as in the RueFo [follow-up research?] programs, in the ZTL (Future Aviation Technology) Program, and in the KEL (Component and Experimental Program for Air) of the BMVg.

Specifically, the research studies in the "aircraft" main points are concentrated on the following technological subgoals within the government program:

Requirement and mission analyses;

Improvement of flight characteristics and flight performances;

Improvements in the area of the airframe.

In addition to the goal of preparing technically advanced developments through research headstart, the DFVLR also views its research work from the angle of securing the subject concept for competent technical counselling of ministries and subordinate agencies in questions of aircraft technology and operation.

The R&D work under main point 2 is oriented by certain guiding concept and should thus guarantee a research effort which will be realistic in terms of practical application and which will be geared toward certain objectives. This work is broken down into programs whose content equally benefits several guiding concepts as well as others which very specifically are tied to one of these guiding concepts. The first-mentioned ones have the character of a target-oriented basic research effort while the last-mentioned ones are more in the nature of additional follow-up work for possible future projects; this is done in close, firmly agreed-upon cooperation with industry in the context of joint programs (ZKP, KEL, and partly also ZTL).

Program: Development of Methods for Aerodynamic Design--L VE

	1981	1982	**1983**	1984	1985	1986
1	9,9	12,1	**12,1**	12,9	13,8	14,7
2	58	50	**51**	51	51	51

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program. Determination of Aerodynamic Coefficients and Flight Mechanics Characteristics--L BK

	1981	1982	**1983**	1984	1985	1986
1	5,5	4,4	**4,5**	4,8	5,1	**5,5**
2	28	25	**25**	25	25	25

Key: 1--Costs (in millions if DM); 2--Personnel (man-years).

Program: Control and Regulating Concepts for Aircraft--L SR

	1981	1982	**1983**	1984	1985	1986
1	4,9	5,4	**5,4**	5,8	6,2	6,6
2	35	33	**33**	33	33	33

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Weight Reduction, Lifetime Increase--L GL

	1981	1982	1983	1984	1985	1986
1	10,5	13,2	13,2	14,2	15,1	16,2
2	73 *)	80 *)	79	79	79	79

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Airline and Transport Aircraft--L VF

	1981	1982	1983	1984	1985	1986
1	7,4	7,7	7,7	8,3	8,9	9,5
2	45	41	41	41	41	41

Key: 1--Costs (in milions of DM); 2--Personnel (man-years).

Content and Objective

The program's higher objective is to create the technological prerequisites for the industrial utilization and integration of the following-named innovation items which are urgently needed for the next generation of transport aircraft, above all in the context of the Airbus Program.

Introduction of highly-stressable structures made of composite fiber materials;

Introduction of the supercritical and active wing;

Digital integrated flight control system with active control surfaces (DIFAS).

From this we can derive the following medium-term subgoals:

Use of composite contruction methods in primary structures; influence of defects in composite working materials and structures upon their stressability; repairability of composite structures; investigation of novel fiber/matrix combinations under realistic operating conditions; technology investigations on civilian component developments in industry.

Improvement of existing design methods for supercritical wing; use of technology of supercritical wing with new profile and wing shapes; development of a flat system in the slow-flight range; investigation of interference questions connected with wing-fuselage-engine combinations.

Use and adaptation of digital signal processing through construction systems regarding the functions and operational types required in transport aircraft; integration of manual, semi-automatic, and fully-automatic operating types and functions into the overall system; determination of optimum flight-phase control dynamics, using active control surfaces according to flyability and performance criteria; use of active control surfaces for the attenuation of

interference magnitudes and structure, considering aeroelastic factors; design of the sensor concept with respect to accuracy, reliability, and equipment-engineering expenditures, including the inertial strapdown technology, air data sensors, and the microwave landing system; design of cockpit control panels for transport aircraft as well as systems for the operation of the integrated digital flight control system by the pilot.

Current Situation

In view of the objectives mentioned above, we want, at this point, to mention the following examples of completed or current work projects from the work areas of structural mechanics, mechanics of fluids [flow mechanics], flight mechanics, and flight control:

In the field of glue connections, the effect of simulated operational testing climates (temperature, humidity) on glueing of CFK [carbon-fiber-reinforced synthetics] laminates was investigated to support the "Airbus CFK vertical tail surfaces." The results reveal an improved performance of new glue developments in combination with stresses under high temperatures.

The "Aerodynamic Performance and Flyability Improvements on Subsonic Transport Aircraft" Research Program (ALFAST) was defined with a view to a concept for fuel savings.

Investigations for the determination of the flyability limits of transport aircraft with reduced static stability in the context of the ZKP II task "ACTTA" [Advanced Control Trans-sonic Transport Aircraft] led to flight tests by means of in-flight simulation with rear center of gravity positions of 35-55 percent average wing depth.

As part of the work on a sensor system for the integrated digital flight control system, a concept was improved for analytical redundancy of flight regulator sensors in such a way that it is possible also to recognize sensor errors which are otherwise difficult to spot.

Implementation, Delimitation, Cooperation

The clients are the aviation industry, MBB, VFW [United Aeronautical Works], Dornier, BGT [Bodensee Equipment Engineering], and DLH [German Lufthansa].

There is cooperation or scientific contact with the following: LBA, NASA, NLR, ONERA [National Office of Aerospace Studies and Research], RAE [Royal Aircraft Establishment], Braunschweig Technical University, MBB, Dornier, VFW, BGT, DLH, and, within the context of GARTEUR [Group for Aeronautical Research and Technology in Europe].

Program: Combat Aircraft of the 1990's--L KF

	1981	1982	1983	1984	1985	1986
1	3,0	5,0	5,0	5,4	5,2	5,6
2	17	23	23	23	21	21

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

On the basis of the military requirements, combat aircraft of the 1990's are to push into regions of flight through which nobody has flown so far. For this purpose it is necessary to include new technologies in the development of these aircraft. The technological headstart furthermore must be secured for future combat aircraft generations.

The following are medium-term goals:

Exploration of the area of bigger attack angles during stable flight and full controllability;

Increase in range and raising the buffeting limit through supercritical profiling;

Utilization of forward sweepback and aeroelastic tailoring;

Reduction in tail pressure resistance and production of interference resistance between engine and airframe;

Reduction of flying weight, improvement of aeroelastic properties and reduction of radar spottability through the use of CFK structures;

Development of more high-performance matrix working materials for thermally more highly stressable composite working materials;

Description of aircraft dynamics in the entire flight range for parameter identification, for judgment of operational flight properties;

Development of digital technique for aircraft control systems in combination with fly-by-wire control systems;

Solution of control problems in new types of combat aircraft with the involvement of anthropological engineering viewpoints;

Development of unproblematical recovery methods for reusable RPV's.

Current Situation

Preparing a calculation method for modern combat aircraft dynamis, development and surveying of supercritical profiles with maneuvering flaps for combat aircraft,

investigations for the reduction of the tail pressure resistance on single-engine and double-engine arrangements, basic investigations of an experimental and theoretical kind on the forward-sweepback wing.

Development of CFK-, GFK- [Glass-Fiber-Reinforced Synthetics], and hybrid construction designs, construction of CFK combat aircraft components (Alpha Jet CFK wing), strength investigations on bolted [screwed] connections, process-engineering investigations on low-cost and light-weight production of CFK wing structures, development of more high-performance mattrix materials, investigations on aeroelastic tailoring.

Testing of the recovery of RPV's using controlled rectangular skydiving parachutes.

Implementation, Delimitation, Cooperation

The research activities are to a great extent based on the RueFo, ZTL, and KEL undertakings of the BMVg and are supplemented by additional continuing work of the DFVLR. To the extent that this involves basic investigations--which, to be sure, are oriented by guiding concepts but which have a broader field of application--they are being worked on the corresponding basic programs (see E LAS: Air reconnaissance systems, image data reduction, interference-proof data transmission; E GFE: Signature questions, radar spotability, sensor engineering; V TF: Strapdown-inertial technique, laser gyros, navigation and control methods for RPV's; L VE: Calculation methods, optimum supersonic intakes; L BK: Derivatives, operational flight properties; L SR: Digital aircraft control system, reliable regulators, digital electrohydraulic adjuster, optimized flight maneuver; L VF: Dial and operating systems; A TAS: Engine technology).

The clients here are the BMVg and the German aviation industry with which investigations are being conducted through close cooperation. Specifically, there is cooperation for special topics with MBB, Dornier, VFW, BGT, IABG [Industrial Plant Operating Company, Incorporated], BWB, Braunschweig Technical University, and Darmstadt Technical University.

Program. General Aviation Aircraft--L AL

	1981	1982	1983	1984	1985	1986
1	1,7	2,8	2,7	2,9	3,1	3,3
2	10	14	14	14	14	14

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program. Missiles--L FK

	1981	1982	1983	1984	1985	1986
1	6,3	7,8	7,8	8,4	9,0	9,6
2	37	46	46	46	46	46

Key: Costs (in millions of DM); 2--Personnel (man-years).

Program: Aircrat--L DF

	1981	1982	1983	1984	1985	1986
1	8,6	8,5	8,4	9,0	9,6	10,3
2	58	50	50	50	50	50

Key: Costs (in millions of DM); 2--Personnel (man-years).

Program: Cryo-Wind-Tunnel Engineering--L KW

	1981	1982	1983	1984	1985	1986
1	4,0	3,7	3,8	4,1	4,4	4,7
2	23	22	22	22	22	22

Project Support: Aircraft Projects--L P

	1981	1982	1983	1984	1985	1986
1	13,0	8,5	9,2	9,8	10,5	11,3
2	40	43	43	43	43	43

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

Under project support we combine additional and follow-up work for already specifically defined projects which are either being developed, tested, or used. The task assignment under this service provided by DFVLR is worked out by third parties.

Current Situation

The tasks that were agreed upon or are to be expected will be found in the following fields:

Additional and follow-up work for the Airbus A-310.

Measurement of stationary and nonstationary force and pressure distribution along profiles [section pieces] and models of additional aircraft, missiles, helicopters, and unmanned flying equipment, for low-speed and high-speed wind tunnels, as well as stationary vibration experiment systems.

Flight path surveying, flight simulation, computer simulation.

Flight property investigations.

Testing of stabilization systems of missiles.

Cooperation in investigations on the causes of aircraft accidents.

Tubular construction methods.

Static and dynamic structural calculations.

Investigations for the use of composite fiber working materials.

Damage factors (CFK repair possibilities).

Technical consultation and support of ministries and subordinate government agencies with the goal of providing scientific and technical foundations for work and decisions by requesting agencies.

Support of the DNW during survey undertakings, development and production of technical measurement components as well as software development.

[pp 3-1--3-7]

Main Point 3. Turbo Propulsion and Fluid-Mechanics Engines--A

	1981	1982	1983	1984	1985	1986
1	31,6	29,4	29,3	31,4	33,1	35,2
2	202	188	186	186	184	184

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Efficient fossil energy use for propulsion purposes is of economic interest due to the rise of the costs of these energy sources. The reduction of undesirable side effects on the environment, such as the emission of noxious substances and noise, is just as important.

The work on this main point makes the following contributions:

Improvement of designs for turbo engines and fluid-mechanics engines regarding economy, specific performance, specific fuel consumption, lifetime, operational reliability, and raw materials available in the future. By virtue of the new profile geometries, working materials and cooling methods, the performance is

to be improved, the specific fuel consumption is to be reduced, and an effort is to be made to use lower-quality fuels.

Drafting the fundamentals for the improved design of combustion chambers in gas turbines as well as combustion chambers in diesel and reciprocating internal combustion engines. In addition to the reduction of noxious substance emission with optimum utilization of conventional fuels, more and more work is being done on questions connected with the use of alternate fuels.

Testing and development of noise reduction methods and processes for aircraft, ground-based means of transportation, as well as industrial processes and plants.

Development of scientific knowledge and technological experiences to increase the specific energy and efficiency of IR lasers and a high-energy laser with short wavelength.

Program: Design Fundamentals and Working Materials for Fluid-Mechanics Engines--A EWS

	1981	1982	1983	1984	1985	1986
1	8,1	8,6	**8,2**	8,8	9,1	9,7
2	54	51	**50**	50	48	48

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Optimization of Combustion Processes for Combustion Chambers with Minimum Noxious Substance Emission--A OV

	1981	1982	1983	1984	1985	1986
1	4,6	4,7	**4,7**	5,0	5,4	5,8
2	33	32	**32**	32	32	32

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Performance Increase in Turbo Engines and Fluid-Mechanics Engines--A TAS

	1981	1982	1983	1984	1985	1986
1	6,3	5,4	**5,5**	5,9	6,3	6,7
2	39	36	**37**	37	37	37

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Noise Reduction--A LM

	1981	1982	1983	1984	1985	1986
1	3,9	4,6	3,7	4,0	4,1	4,2
2	28	31	23	23	23	23

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: High-Energy Laser--A HEL

	1981	1982	1983	1984	1985	1986
1	4,0	4,7	5,2	5,6	6,0	6,4
2	28	31	36	36	36	36

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

The higher program goal is the development of scientific discoveries and technological experiences for the use of high-energy lasers in military technology and in material processing.

In the defense sector, research studies are oriented in long-range terms toward the use of the laser during the 1990's; the mobility of the system as well as the transmission of laser light through the atmosphere are of decisive significance here.

Looking at material processing, easy handling during the work process (cutting, welding, hardening) as well as low investment costs are necessary prerequisites for large-scale technical laser use.

Here are the direct scientific-technical subgoals:

Increase in specific energy and efficiency of IR high-energy gas lasers;

Investigation and development of new laser systems for short wavelengths (close-in IR to UV);

Improvement of ray quality in fluid lasers.

In the field of IR lasers, the main emphasis in the investigations is on the electrically energized supersonic CO laser, in the electrically energized CO_2 laser, as well as in the combustion-operated chemical (deuterium-fluoride) DF laser.

Looking at the electrically energized lasers, the emphasis is on the stability of electrical discharges in gas currents as well as their superpositioning with

an optical resonator in order to raise the specific energy of these lasers. The influence of acoustic disturbances on the homogeneity of the discharge is decisive for the optimization of the laser especially in case of pulsed laser operation.

In the case of the chemical laser, process-engineering questions--especially the capacity of a "chemical pump"--constitute the main emphasis in the investigations.

In the field of new laser systems, the accent in our work in on the recombination laser. Here, investigations are concentrated on the kinetics of the recombination processes in various discharge configurations with differing cooling mechanisms, such as adiabatic expansion (plasma-dynamics lasers) and the reciprocal interaction with cold background gas.

The optical quality of the laser ray (mode image) decides on the laser's successful use both in the defense sector and for civilian uses. This is why investigations of various resonator arrangements are being newly included in the program.

Current Situation

It was possible to raise the combustion-operated chemical DF laser to a capacity of 1.3 kw with the final nozzle lattice. It was possible to prove that a chemical pump on a Ca base can work properly. Laser-relevant values have already been achieved through progress in Ca preparation.

It was possible to operate a CO_2 laser with microwave excitation in the supersonic flow at 300 w; "air-breathing" operation was also successfully evidenced.

Production engineering difficulties came up in connection with the CO waveguide laser and this considerably delayed the progress of work here.

The subsonic CO_2 laser with high-frequency excitation currently supplies 2.5 kw at 20-percent efficiency. An unstable resonator was also tested on this unit for the first time and it provides effective focusability in the remote radiation field.

Implementation, Delimitation, Cooperation

The defense equipment program part is coordinated in pertinent conferences with the BMVg and with work being done outside DFVLR.

The civilian program part, which deals with material processing, is coordinated with industry through numerous contacts. Here, "surface treatment" plays an increasingly important role, especially in conjunction with multikilowatt lasers, along with "separation and joint."

Project Support: Propulsion Engineering Projects--A P

	1981	1982	1983	1984	1985	1986
1	4,7	1,4	2,0	2,1	2,2	2,4
2	20	7	8	8	8	8

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

[pp 4-1--4-5]

Main Point 4. Non-Nuclear Energy Systems--S

	1981	1982	1983	1984	1985	1986
1	14,1	21,4	22,5	23,7	24,7	26,6
2	93	127	130	130	126	126

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Efficient energy use and the exploration of renewable primary energy sources are of special economic and political interest on the basis of the foreseeable exhaustion of fossil primary energy sources (above all petroleum).

Work on this main point is making contributions here in the following three fields:

Efficient Energy Use in Home Energy Sector

A very large portion of energy is used in the "private household" sector. This is why studies are being carried out on the improvement of oil burners, waste gas heat utilization, the development of absorption heat pumps, as well as the optimization of solar energy systems to promote the better use of primary energy employed so far and of environmental energy for space heating and hot-water preparation. Moreover, mathematical models are being assembled for the design of renewable home energy systems and a test field has been designed for future home energy technologies.

Use of Renewable Primary Sources

Renewable primary energy sources can in long-range terms above all make a contribution to decentralized energy supply. For this purpose, solar and wind energy systems are being investigated within the context of international projects (SOPHET [Solar Process Heat Technology Program], SONNTLAN, DEBRA, Fernando de Noronha).

With a view to the future potential of large-scale technical manufacture of process heat and current, large-scale solar-heat plants and their components are being investigated (for example, reflector field optimization, working material development; see also GAST [Gas-Cooled Solarium Power Plant] Technology Program and SSPS [Small Solar Power Systems] Project).

Use of Hydrogen as Future Secondary Energy Source

New secondary energy sources are becoming necessary because of the foreseeable shortage of oil and natural gas as energy sources.

Studies are now being conducted on hydrogen production by means of photovoltaic solar generator as basis for the future introduction of hydrogen to be used as secondary energy source. Favorable storage and transport properties as well as the easy convertibility into other energy forms are being tested and evidenced in selected application technologies (use of liquid hydrogen, hydrogen-oxygen steam generators, safety-engineering investigations).

The studies on solar and wind energy use are making an important contribution to technology transfer going to developing countries.

Work on this main point this creates prerequisites for the preservation of economic competitiveness and for the increase in technological capacity for energy engineering in the FRG.

The "Development Lines for Renewable Energy Systems" undertaking under the ST [Study Program] (see page 0-1 [of original]) is closely connected with the programs under this main point. These studies are being defined and carried out in coordination with the essential questions under this main point.

Program: Renewable Energy Systems--S RE

	1981	1982	1983	1984	1985	1986
1	6,5	6,8	7,0	7,5	8,0	8,6
2	49	47	47	47	47	47

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Large Solar Heat Plants--S SG

	1981	1982	1983	1984	1985	1986
1	2,0	2,5	2,6	2,8	3,0	3,2
2	12	17	17	17	17	17

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Hydrogen as Secondary Energy Source--S WS

	1981	1982	1983	1984	1985	1986
1	2,7	3,9	4,0	4,3	4,6	4,9
2	20	29	29	29	29	29

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Project Support: Energy Engineering Projects--S P

	1981	1982	1983	1984	1985	1986
1	2,9	8,2	8,9	9,1	9,1	9,9
2	12	34	37	37	33	33

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

[pp 5-1--5-4]

Main Point 5. Satellite Communications and Location--K

	1981	1982	1983	1984	1985	1986
1	7,6	9,0	9,1	9,8	10,3	11,1
2	57	69	69	69	68	68

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Technical communications are assuming growing significance for the social and economic development of industrial nations and developing countries. Satellites will play a growing worldwide role as a component of digital networks.

The research of the DFVLR in this field is concentrated on the development of methods and technologies for high-rate data transmission for mobile radial and position location systems and for digital television and radio supply by means of satellites. Here again we must mention the interconnected computer system via satellites and the attendant investigations of the interfaces with land networks and their operations. These investigations are being carried out not only by means of studies but also through experimental programs.

The research tasks accomplished under this main point are oriented by the "Technical Communications" Technology Program as well as by the work targets of the following promotion sectors: "Data Processing," "Communications Technology," and "Space Research and Engineering" of the federal government.

Program: Fundamental Investigations on Future Communications and Position-Finding--K GKO

	1981	1982	1983	1984	1985	1986
1	3,9	4,6	4,7	5,1	5,3	5,7
2	27	32	32	32	31	31

Key: 1--Costs (in millions of DM); 2--Personnel (man-years)

Content and Objective

The program's goal is the preparation of basic knowledge for subsequent investigations of future, especially mobile systems of communication and position-finding.

Communications between mobile subscribers today--judging by the mechanical possibilities--are still very inadequately developed. Present-day radio position-finding systems can meet the growing requirements for traffic surveillance and navigation only very inadequately regarding coverage and accuracy.

Satellite systems will be in a position in the future considerably to improve this situation. They guarantee that subscribers can be reached over large areas or perhaps even worldwide and they permit the transition to higher frequencies on the transmission channel. This creates considerably greater transmission band widths for communication and considerable accuracy increases for position-finding and navigation. A knowledge of the effect of the propagation medium will be of special importance in the design of systems for frequency of more than 10 GHz. We can expect particularly good economy of operation for such large-surface systems with large numbers of users.

Medium-term subgoals are as follows:

Working out and investigating adaptive modulation and coding methods in order to improve the transmission quality in case of variable-time, non-Gaussian interference. What we want here is method proposals in the field of mobile data radio broadcasting for special users.

Design and construction of a measurement system for propagation experiments with high frequencies. Technical measurement recording of transmission channel and descriptions through simulation models for antennas and propagation link. Investigation of performance capacity of technologies and components for frequencies of > 10 GHz.

Clarification of procedural questions and technical problems for future systems of satellite-based position-finding. A transmission link will have to be built up for coded time signals in the context of theoretical and experimental investigations and satellite experiments will have to be prepared and carried out.

Current Situation

The "principle of the stored channel" has proved itself and is being used in many ways. Modulation and coding methods are being carried out in a digital form and are being tested through simulation in real channels.

The originally purely experimental satellite concept for the exploration of new frequencies (20-30 GHz) for satellite communication was amended in the direction toward pre-operational or operational partial use. The construction of the measurement station with weather radar is being continued under correspondingly more general viewpoints (L-Sat., national satellite). These satellite propagation experiments in the L-band have been completed.

The NAVEX experiment was included in the D-1 shuttle mission. The presumed launch date is 1985. The technique developed in this connection was used for GPS reception experiments and for time transition experiments with OTS-2.

Implementation, Delimitation, Cooperation

The clients here are the BMFT, BMVg, the air and space industry, Telefunken, SEL, Dornier, ERNO, BKA, the German Federal Post Office, ESA, INMARSAT, and CCIR [International Radio Communications Consultative Committee].

Cooperation is being pursued with the Aviation and Space Institute of the Berlin Technical University, German Federal Post Office (FTZ/FI [Research Institute of the Central Telecommunications Engineering Bureau of the German Federal Post Office]), the HHI [Heinrich Hertz Institute], the Communications Technology Institute of the Munich Technical University, SEL, the Braunschweig PTS, COMSAT, ESA, NTNF Norway.

Scientific contacts are being maintained with Appleton Laboratory, Slough, England; Georgia Institute of Technology, National Research Council of Canada, Graz Technical University, IFAG, Frankfurt.

Program: Communications Systems for Stationary Subscribers--K KO

	1981	1982	1983	1984	1985	1986
1	2,1	2,7	2,7	2,9	3,1	3,3
2	17	25	25	25	25	25

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

The central element in modern, satellite-assisted communication consists of the heterogeneous ground radio stations which are close to the users, combined with land links. They facilitate the implementation of varying digital services (for example, language [voice], wide-band data transmission, fixed and mobile images, etc.) within a common network (Integrated Services Digital Network or ISDN). Fundamental questions relating to the use of communications satellites for ISDN communications systems and questions of the optimum digitalization of sound and image were worked on in this program with the help of this guiding concept.

Realistic experiments are being carried out by way of support in order to determine technical possibilities, design parameters, and performance characteristics. The foundation here consists of the modular, process-computer-controlled experimental system (the test bed) which was built up in recent years. In line with the guiding concept, consideration is being given here to the transmissions of digital communications at high bit rates and varying link conditions via satellites in systems which many users with differing requirements reach for.

These performance parameters and the technical properties are the basis for a system model which is being gradually built up on a computer. With its help, a foundation is being worked out for judging and optimizing satellite-assisted communications systems. The SATNET Experiment of DARPA [Defense Advanced Research Projects Agency] offers the possibility here for studying the capacity of transmission records, information processing volume, and running times on an experimental system with fixed, load-dependent multiplex method. The necessary software technology is being worked out on this basis for the control of ISDN networks.

The combination of differing digital services through a control processor as well as high-capacity retrieval and network control methods are being developed and tested in the CODLINK Experiment which is being carried out together with COMSAT. Investigations on individual synchronization and access methods are being carried out parallel to this via the OTS satellite.

The experiences and results of these studies in SATNET and CODLINK are being combined in the satellite-assisted interconnected computer grid and communications experiment (SARKE). In this connection, technical questions of network control and management as well as the network interconnection of data processing systems are being studied in an experimental, satellite-assisted communications system with one, each, ground radio station at each DFVLR research center in order to work out the most economical and most high-capacity system design as possible, considering differing requirements.

Current Situation

The SATNET Experiment was started in 1982 and was placed in operation in the host computer. A comprehensive measurement program is planned for 1983.

The first phase of the CODLINK Experiment has been completed; phase 2 began at the end of 1982.

The erection of the ground radio stations for SARKE in the DFVLR research centers was planned and started together with the DBP [German Federal Post Office]; the ground radio station in Oberpfaffenhofen was place in operation as the first station here and in the meantime has also been used for initial broadcasting experiments.

Experiments for time transmission and open-loop synchronization have also been started through OTS.

Implementation, Delimitation, Cooperation

In addition to basic coordination of activities with the BMP and BMVg, there is close cooperation with FTZ, FI, and FFM, with COMSAT, DARPA, other large-scale research installations, and German industry.

The clients for this guiding concept are BMP and BMVg.

Project Support: Communications and Position-Finding Projects--K P

	1981	1982	1983	1984	1985	1986
1	1,6	1,7	**1,7**	1,8	1,9	2,1
2	13	12	**12**	12	12	12

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

[pp 6-1--6-6]

Main Point 6. Earth Observation--E

	1981	1982	1983	1984	1985	1986
1	32,9	36,7	**36,2**	38,9	40,8	43,7
2	188	182	**178**	178	175	175

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Using aviation and space technology knowledge, the earth observation main point is intended to resolve questions of clarification and problems of large-area exploration of atmospheric and terrestrial phenomena. These practical application-oriented research studies among other things are making contributions to cartography and space planning, to the solution of problems in developing countries, and to the surveillance and preservation of the environment.

The DFVLR research activities here extend to the exploration and practical-application-related development of reconnaissance techniques and systems. Special main points in research consist of optical, IR, and microwave survey methods for the earth's surfaces and the atmosphere as well as the development of simulation and interpretation models for the processing of the information obtained. These also involve theoretical-meteorological models.

The research studies are mostly guided by the requirements from the practical application area of meteorology, anthropogenic stress of the atmosphere, oceanography, land use, and military technology. Guiding concepts, especially for civilian technological studies, consist of the European or international observation systems for the earth's surface and the atmosphere from outer space which are planned for the future.

The investigations on future possibilities of reconnaissance technique for earth-science questions and on atmospheric research, which so far are contained in the "Reconnaissance Techniques of the Future" study program, will, as of 1983, be combined into a common "ST Study Program" together with the study activities under all other main points (see page 0-1 [of original]).

Program: Long-Range Reconnaissance Fundamentals--E GFE

	1981	1982	1983	1984	1985	1986
1	6,1	7,0	**6,8**	7,3	7,3	7,8
2	37	34	**32**	32	30	30

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

The program's goal includes technologies of long-distance surveying in order to determine and characterize the type and condition of the environment and the invidual objects in it. Experimental studies and the development of theoretical models are necessary for this purpose.

Electromagnetic methods are being investigated as a main point (frequency range from very long waves via microwaves and millimeter waves and, IR all the way to the optical spectrum). The selection of the best-suited frequency range for the clearest possible characterization of a given object is also a task under this program.

Here are the subgoals:

Analysis of radiation emission and reflection from objects and environment as function of the object parameters, such as shape, surface and deep structure, material, material state, etc., as well as sensor parameters, such as type of polarization, wave shape, direction of observation, etc.;

Explanation of propagation losses and phase distortions in atmosphere between sensor and object as well as multichannel effects;

Conception of new sensors and sensor systems as well as development of novel survey methods and their experimental varification;

Improvement of the DIBIAS [Digital Interactive Image Analysis System] image processing system, method research in image processing, and practical-application-oriented image data analysis.

The application areas of these studies extend from earth reconnaissance via medical diagnostics and planet exploration all the way to military reconnaissance.

Current Situation

Comprehensive signature data of individual targets and various background types were gathered with radar, microwave, and IR radiometers both from the ground and from the air.

The available sensors, most of which were designed and built in-house, are being further developed. The emphasis in new developments rests with the milimeter waves.

Comprehensive experiences with the expanded DIBIAS system is being used in the processing of satellite data. Future studies are aimed at flexible systems and optimum analysis of multisensor data.

While the interpretation of survey data and the possibility of object classification in the microwave and millimeter wave region above all in the case of natural objects are still mostly in their beginnings, they have made definite progress in the case of IR and above all optical signatures--in keeping with direct accessibility through the human sense of vision--on account of the high resolution as well as the clear scatter processes. Microwaves guarantee extensive independence of reconnaissance from the weather and supply additional data because of the greater wavelength. Efforts to interpret these data and to design new survey methods are being stepped up.

Implementation, Delimitation, Cooperation

The program is guided by questions from possible future users in the civilian and military sectors. In particular there is intensive cooperation--partly in the form of joint projects--with numerous colleges, with other research and experimental institutions at home and abroad, with international installations such as ESA and NATO, and with several industrial companies. The military aspects of these studies are being coordinated with the BMVg.

Program: Fundamentals and Application of Atmospheric Reconnaissance--E GAE

	1981	1982	**1983**	1984	1985	1986
1	10,3	10,6	**10,3**	11,1	11,9	12,8
2	60	61	**59**	59	59	59

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Reconnaissance with Spacelab and Satellites--E ESS

	1981	1982	**1983**	1984	1985	1986
1	5,6	7,0	**7,0**	7,5	8,0	8.6
2	34	34	**34**	34	34	34

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Air Reconnaissance Systems--E LAS

	1981	1982	**1983**	1984	1985	1986
1	2,6	4,2	**4,2**	4,5	4,8	5,1
2	19	25	**25**	25	25	25

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Project Support: Reconnaissance Projects--E P

	1981	1982	1983	1984	1985	1986
1	8,3	7,9	**7,9**	8,5	8,8	9,4
2	38	28	**28**	28	27	27

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

[pp 7-1--7-5]

Main Point 7. Space Systems--R

	1981	1982	1983	1984	1985	1986
1	58,8	64,1	**67,1**	67,8	70,9	75,9
2	243	229	**224**	224	220	220

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

The development of space systems is increasingly determined by economic considerations although, in addition to increased commercial utilization, science constitutes the most important driving force behind space efforts in Europe. The attendant national tasks are guided by the "Space Program of the FRG," especially the subprograms contained in it, that is, "Space Research and Space Engineering" as well as "Extraterrestrial Basic Research."

Here are the overlapping technological objectives in the area of space engineering research:

Further development of practical application satellites;

Use of Spacelab as laboratory and platform for experiments;

Use of satellite engineering for the expansion of scientific knowledge and for direct surveying tasks.

As the national space organization, DFVLR believes that its main tasks reside in the conduct of system-analysis and mission-analysis investigations in the development of new technologies and methods for the construction and operation of future manned and automatic orbital systems as well as in the development of experimental and work techniques under reduced gravity. It furthermore operates experimental and operating installations for space, it assumes planning and management functions for space projects, and it advises ministries and government agencies.

DFVLR uses guiding concepts for future communications satellites and earth observation satellites as foundation for space-engineering research in satellite technology, also in the field of large, controllable light-weight structures.

Important tasks include the use of induced as well as natural properties of space for experiments in work material research and process engineering as well as extraterrestrics, biophysics, and biomedicine.

The DFVLR continues to support the use of Spacelab by providing advice for national and European experimenters in the preparation, adaptation, and implementation of experiments, the selection and training of payload experts, as well as the attendant data transmission and data processing. The tasks connected with payload operation, including crew support, data management, and mission backup support, are to be taken over here also within the framework of the national Spacelab-Mission D1.

Besides, mission operations for SYMPHONIE are being carried out, ground operation systems are being planned for new projects such as TV-SAT, AMPTE, GALILEO, and ROSAT, the rocket test stands are being used in a national and European context (ARIANE), and programs are being carried out with high-altitude research rockets and balloons (TEXUS, MAPWINE, CAESAR, INTERZODIAK, and STRAFAM) in the field of extraterrestrics and working material research.

Program: Satellite and Platform Technology--R ST

	1981	1982	**1983**	1984	1985	1986
1	5,2	6,8	**6,5**	7,0	7,5	8,0
2	35	41	**36**	36	36	36

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

Satellites and platforms are the orbital infrastructure of unmanned space travel during the 1980's and 1990's. The program's goals are to expand the present-day utilization possibilities of this infrastructure, to reduce production and operating costs for the space travel segment, and to increase the performances for better utilization. Specifically target-oriented system analyses and the development of new technologies for the design, construction, and operation of future orbital systems are required for this.

Design and system-engineering investigations for future space platforms, conversion of user requirements into space flight engineering proposals.

Path mechanics and mission analysis for practical application satellites, scientific satellites and recoverable platforms, working out new methods for rendezvous and docking.

Design, mathematical model formation, and tests of new adjusting members for attitude [position] adjustment, investigation on the lubrication of rotating mechanisms and ceramic structural parts. Design of mechanisms for docking and for the coupling of large space structures [vehicles].

Determination of the thrust vector errors of AOCS engines in case of jet-skirt deformation due to satellite structural parts, computation of the resistance, lift, and moment coefficients for satellites and platforms on earth orbits, determination of μg conditions for working material experiments.

Suitability and production possibilities of fiber-reinforced work materials for large space flight structures, stability behavior of long, thin-walled rods, expansion of model coupling methods, including nonlinear structural elements.

Current Situation

A start has been made toward the determination of the long-range requirement for larger space structures [vehicles]. Initial designs are available for the steps in the development of future space platforms.

Computation methods and computer programs for orbit analyses and optimum maneuvers were developed on the basis of specific applications. A method for autonomous on-board position maintenance has been documented and can be passed on to the user.

The dynamic behavior of magnetically positioned flywheels was measured in physical simulations on the air bearing [cushion] table and then modeled mathematically. The optimum design of regulator circuit dynamics of the active magnetic bearing was investigated and checked out experimentally. Methods for layer thickness determination of the lubricant in a dry lubrication system were developed and led to an improvement of the position system for slow rotary movements.

The impacting of satellite structural surfaces by the jet-skirt of engines was investigated for ESA. A computer program was worked out for the calculation of the aerodynamic coefficients of satellite configurations with partial shading [masking].

Thermal cycle tests on CFK laminates for large space structures revealed crack formations in the matrix which are again reduced as the number of cycles grows. Rigidity on the other hand decreased almost uniformly with growing number of cycles. Prepregs for the investigation of thermoplastics are being drafted in DFVLR. Modal coupling and correction methods were developed for the description of the dynamic properties of large space vehicles.

For the design of the regulators for the active attenuation of structural vibrations, an integrated design method was developed with which one can simultaneously position adjusting members and sensors and compute return amplifications. A physical experiment was built up in the laboratory to check out the analytical investigations.

Implementation, Delimitation, Cooperation

Customers for studies under the program are ESTEC, MPI, the University of Cologne, the University of Munich, Dornier, Kugelfischer, MBB, TELDIX, INTELSAT, and TV-Sat.

There is technical cooperation with Dornier, ERNO, and MBB.

Scientific contacts are being maintained with NASA, CNES, ESOC, ESTEC, and Munich Technical University.

Program: Spacelab Experiments and Technologies--R SET

	1981	1982	1983	1984	1985	1986
1	6,5	6,9	7,4	7,4	7,6	8,1
2	50	43	43	43	42	42

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

The environmental conditions connected with space flight are characterized by reduced gravity, energy-rich particle radiation, as well as reactive residual atmosphere, and facilitate scientific experiments which promise new knowledge that cannot be attained in a laboratory setting on earth.

This includes the following:

Fluid mechanics of fluids [liquids] or gases, excluding gravity convection.

Rigidification of melts under reduced gravity for the production of monocrystals with a high degree of perfection, novel alloys, or dispersed systems.

Investigation of gravity-influenced, physical-chemical phenomena, as well as critical phenomena, phase transitions, or dissipative structures.

Biological and medical investigations of the sense of gravity and of the influence of gravity on cellular function.

Exobiological observations of the effect of extraterrestrial radiation climate on living cells.

Direction of flow approaching a missile through reactive thermosphere at orbital altitudes.

Current Situation

Studies in 1982 are concentrated mainly on the manufacture and testing of flight hardware to be delivered for experiments which are to be flown this year during the TEXUS 5/6, OSTA-2 missions as well as in 1983 during SL-1 and in 1984 with LDEF. Preparations and development work is furthermore in progress on experiments for the D-1 mission and drafts are being prepared on proposals for further participation in the TEXUS and MAUS projects.

Specifically this involves the following flight experiments:

SL-1: Advanced biostack, microorganisms, and biomolecules in an outer space environment;

LDEF: free-flyer biostack;

D-1: Frog statolite, cell cycle, and protoplasmatic flow in Physarum Polycephalum, measurement of radiation distribution, embryogenesis and organogenesis of Carausius Morosus, reaction of single-cell organisms to heavy ions of cosmic radiation, bubble transport through chemical waves, phase separation at critical point;

MAUS and other carriers: Doping strips in semiconductor crystals, transport phenomena in case of directed rigidification, stability of dispersions, superposition of rotation and Marangoni convection in suspension zones, orbital molecular flow approach.

Measurment-engineering and process-engineering investigations for the ground tracking program of material sciences and biology are another main point in this work.

Implementation, Delimitation, Cooperation

Through cooperation with other experimenters with the goal of joint experiment implementation an attempt is being made in interdisciplinary study groups early to recognize and solve fundamental problems in experiment implementation also with the participation of external research teams. Scientists from participating institutes are cooperating in corresponding national and international advisory bodies.

Project Support: Project Support for Spacelab Use--R PSL

	1981	1982	1983	1984	1985	1986
1	10,5	18,5	18,7	18,9	19,2	20,6
2	65	81	71	71	68	68

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

Scientific-technical support for the national (BMFT) and European (ESA) program for using Spacelab extends to the following fields:

1. Consultation and support of experimenters and users in the design of their experiments and instruments from system-engineering, operational, and data-engineering viewpoints.

2. Planning and implementation of the operation (on-board and on the ground) of Spacelab missions as well as central processing of payload safety questions.

3. Construction and operation of central experimental and simulation facilities as well as ground operation installations.

4. Medical selection and care for payload experts as well as specificl payload training of flying crew.

Current Situation

Project Support for First Spacelab Mission FSLP

The SPICE project team will continue to be supported in the following fields in the FSLP ESA/NASA Project in the course of the now beginning integration and testing work at NASA/KSC as well as during training for on-board and ground operation at NSAS/MSFC or JSC:

Test of on-board experiment software, training of operating crews (on-board and ground), medical care of crew (crew surgeon), preparation of data processing as well as work on questions of payload safety. The date 30 September 1983 is the current deadline for the execution of the FSLP Mission (SL-1).

D-1 Payload Operation and Payload Safety

The national Spacelab utilization project D-1 has entered Phase C/D. The tasks assumed by DFVLR include all work required for the preparation and implementation of on-board payload operation, including the assignment and medical care of the crew, the specific development of the Spacelab simulator for D-1, and the execution of operational crew training, the preparation of mission support by the payload operation center in Oberpfaffenhofen (GPOC), as well as the central processing and coordination of questions of payload safety and of data and software management. The planned mission deadline is the middle of 1985.

The development of the planned "German Payload Operations Center" is being pushed as part of the GSOC data network system.

The buildup of the basic system of the Spacelab simulator has been completed and its equipment with specific project hardware for the D-1 mission is being continued.

The TEXUS 5/6 double program was carried out successfully.

Implementation, Delimitation, Cooperation

The SPICE team is getting personnel, technical, administrative, and system-engineering support within the context of the SFVLR-ESA agreement. In addition, there is close cooperation in the preparation of Spacelab missions SL-1 (FSLP) and D-1 with the participating scientists, NSAS, ESA, as well as the German space industry.

Project Support: Project Support for Satellites and Probes--R PSS

	1981	1982	1983	1984	1985	1986
1	36,6	31,9	**34,5**	34,5	36,6	39,2
2	93	64	**74**	74	74	74

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

DFVLR supports BMFT-promoted national, cooperative, and European space flight projects, industrial undertakings, and preparatory studies. Here, on the one hand, experience and expertise and, on the other hand, experimental and operational systems are being used at the following main subject points:

Cooperation in studies on new space undertakings;

Buildup of ground stations, data and network systems;

Use of experimental systems and ground operation installations for mission operation of scientific satellites and probes as well as practical satellites;

Preparation and execution of drives aimed at the practical-application-oriented and scientific high-altitude research efforts using rockets and balloons;

Data-technical consultation and support of experimenters and users during the planning, implementation, and analysis of projects and subprojects;

Specification, simulation, and technological testing of payload systems for the preparation of employment in programs and missions;

Analysis and evaluation of technological data for the optimization of mission profile and data yield;

Test and experiment operation of test stands for the qualification of rocket and satellite engines.

Current Situation

The mission operation of both experimental communications satellites, that is, SYMPHONIE 1 and 2, is being continued.

The outdated computer system in the Main Division for Space Flight Missions is being replaced by a complex data network corresponding to the latest state of the art.

The antenna installations at Weilheim are being adapted to the requirements of future projects through the conversion of the 30-m antenna and the construction of five-band antenna.

The mission and ground operation systems for the AMPTE, GALILEO, ROSAT, TV-SAT, and telecommunication satellite projects are in each case in the concept, planning, or implementation phase, depending on the progress of the particular project.

Additional programs are being prepared in the field of high-altitude research with rockets and balloons (MAPWINE, CAESAR, INTERZODIAK, STRAFAM, and Antarctic).

The individual orders encompass activities such as the manufacture of a check-out instrument for ROSAT focal plane instrumentation, the use of computer-controlled on-board systems in rockets, the surveying of satellite orbits, and satellite-engineering investigations.

The DFVLR rocket test stands are being used if necessary for work on the ARIANE delivery vehicle system.

Implementation, Delimitation, Cooperation

The operation of SYMPHONIE 1 and 2 is being continued on the basis of division of labor with CNES.

There is close cooperation within the context of project support with universities, the Max Planck institutes, industrial firms in aviation and space, and space organizations, such as NASA, ESA, CTA, CNIE, ISRO, CNES, and SRC.

[pp 8-1--8-4]

Main Point 8. New Technologies, Technology Transfer--T

	1981	1982	1983	1984	1985	1986
1	12,7	19,4	26,3	28,7	31,4	33,5
2	87	117	160	160	164	164

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

The technical skills, which were acquired through research and development work in their primary application fields under main points 1-7, as well as the available experimental facilities, are used by the DFVLR also for the development of new technologies beyond the original area of application.

Considerable preparatory work is required with the use of R&D capacities for the further development and adaptation of knowledge acquired in the primary application area for broader economic utilization. In addition to some programs relating to longer-term research and development of new technologies, the technology transfer program combines R&S studies on the transfer of technologies and services adapted to the specific requirements of interested enterprises. An effort is being made here to guarantee the essential part of the costs through contract research and service contracts and to get the return from the utilization of know-how and patents.

Research and development on new technologies and technology transfer are concentrated above all on the following:

Motor vehicle engineering;

Rapid-transit line engineering;

Work material development and material processing, especially by means of laser technology;

Combustion engineering;

Home energy engineering;

Diving engineering;

Robot engineering;

Processor and data engineering.

Program: Ground-Based Transportation Systems--T BT

	1981	1982	1983	1984	1985	1986
1	2,8	3,5	3,5	3,8	4,1	4,4
2	19	20	20	20	20	20

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Exploration of New Work and Living Spaces--T ALR

	1981	1982	1983	1984	1985	1986
1	2,4	2,2	2,7	3,0	3,3	3,5
2	20	20	26	26	27	27

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Program: Technology Transfer--T T

	1981	1982	1983	1984	1985	1986
1	7,5	13,7	20,1	21,9	24,0	25,6
2	48	77	114	114	117	117

Key: 1--Costs (in millions of DM); 2--Personnel (man-years).

Content and Objective

This program is aimed at channeling knowledge and skills of the DFVLR toward industrial use also outside the practical application goals of main points 1-7.

This points up the following tasks:

Preparing the knowledge and skills of the DFVLR as well as the potential of its installations and analyzing their usability and protecting them through patents;

Creating utilization possibilities by fostering contacts and by recording requirements for new technologies;

Improving suitable skills for practical utilization and demonstrating the utilization potential;

Illustrating the ability to pass on new technologies to the public;

Working out and following up on agreements with suitable partners concerning the development and use of new technologies and their employment as well as the use of installations of the DFVLR.

Activities under these programs are distributed over smaller individual undertakings, but especially also in short-term defined tasks, over all DFVLR work areas.

A further breakdown of the program into undertakings does not seem to make sense because of the changing tasks.

[p 10-1]

Supplementary Data
Matching DFVLR Main Points and Programs Up with Federal Government Promotion Areas

	1 Angaben in Mio DM	DFVLR	2 Förderbereiche der Bundesregierung				
8 9 10 11	Schwerpunkte Programme Projektunterstützung Projektträgerschaften		3 Luftfahrtforschung		5	6 Weltraumforschung, Raumflugtechnik	Andere Neue Technologien 7
		Sum	Sum	davon von der Wehrtechnik initiiert 4	davon zivil		
12	Studienprogramm	5,6	2,2		2,2	1,7	1,7
	V SI	5,2	5,2		5,2		
	V TF	6,5	6,5	4,3	2,2		
	V NFS	3,9	3,9		3,9		
	V PA	3,1	3,1		3,1		
	V P	3,7	3,7		3,7		
13	Schwerpunkt 1	22,4	22,4	4,3	18,1		
	L VE	12,1	12,1	3,2	8,9		
	L BK	4,5	4,5	0,3	4,2		
	L SR	5,4	5,4	1,4	4,0		
	L GL	13,2	13,2	3,7	9,5		
	L VF	7,7	7,7		7,7		
	L KF	5,0	5,0	5,0			
	L AL	2,7	2,7		2,7		
	L FK	7,8	7,8	7,8			
	L DF	8,4	8,4	4,0	4,4		
	L KW	3,8	3,8		3,8		
	L P	9,2	9,2	5,1	4,1		
14	Schwerpunkt 2	79,8	79,8	30,5	49,3		
	A EWS	8,2	5,6	2,3	3,3		2,6
	A OV	4,7	1,4	0,2	1,2		3,3
	A TAS	5,5	4,2	2,4	1,8		1,3
	A LM	3,7	3,1		3,1		0,6
	A HEL	5,2	4,4	4,4			0,8
	A P	2,0	1,7	0,7	1,0		0,3
15	Schwerpunkt 3	29,3	20,4	10,0	10,4		8,9
	S RE	7,0					7,0
	S SC	2,6					2,6
	S WS	4,0					4,0
	S P	8,9					8,9
16	Schwerpunkt 4	22,5					22,5
	K GKO	4,7	1,6	0,6	1,0	1,0	2,1
	K KO	2,7	0,5	0,5			2,2
	K P	1,7	0,3		0,3		1,4
17	Schwerpunkt 5	9,1	2,4	1,1	1,3	1,0	5,7

[Continued on following page]

[Continued from preceding page]

	E GFE	6,8	3,8	3,8			3,0
	E GAE	10,3	2,0	1,4	0,6	7,1	1,2
	E ESS	7,0				7,0	
	E LAS	4,2	4,2	4,0	0,2		
	E P	7,9				2,1	5,8
18	Schwerpunkt 6	36,2	10,0	9,2	0,8	16,2	10,0
	R ST	6,5				6,5	
	R SET	7,4				7,4	
	R PSL	18,7				18,7	
	R PSS	34,5				34,5	
19	Schwerpunkt 7	67,1				67,1	
	T BT	3,5					3,5
	T ALR	2,7	0,3	0,3			2,4
	T T	20,1	2,0		2,0	0,3	17,8
20	Schwerpunkt 8	26,3	2,3	0,3	2,0	0,3	23,7
	PT R	19,3				19,3	
	PT NT	11,1					11,1
	Σ	**328,7**	**139,5**	**55,4**	**84,1**	**105,6**	**83,6**
21	+ Nicht-FE-bezogene Kosten	40,4	18,3	7,5	10,8	14,0	8,1
22	Gesamtkosten	369,1	157,8	62,9	94,9	119,6	91,7
23	– Durchführung von Projektträgerschaften (Einzelkosten)	26,2				16,2	10,0
24	– Durchführung von projektgeförderten Aufgaben (Einzelkosten)	12,5	1,0		1,0	4,8	6,7
25	– Abschreibungen	37,2	16,6	8,1	8,5	12,6	8,0
26	– Veränderungs-Position Betrieb	0,3	0,3		0,3		
27	Ansatz Betriebsmittelplan	282,9	139,9	54,8	85,1	86,0	67,0
	+ Ansatz Investitionsmittelplan	51,5	35,0	8,2	26,8	11,2	5,3
28	Wirtschaftsplanansatz Gesamt	344,4	174,9	63,0	111,9	97,2	72,3
29	– Eigene Erträge	49,0	8,3	2,8	5,5	7,7	33,0
30	Zuwendungsbedarf Gesamt	**295,4**	**166,6**	**60,2**	**106,4**	**89,5**	**39,3**
31	davon: BMFT	211,7	95,8	–	95,8	80,5	35,4
	BMVg	56,2	56,2	56,2	–	–	–
32	Länder	27,5	14,6	4,0	10,6	9,0	3,9

Key: 1--Figures in millions of DM; 2--Federal government promotion areas; 3--Aviation research; 4--Including initiated by military technology; 5--Including civilian; 6--Space research, space technology; 7--Other new technologies; 8--Main points; 9--Programs; 10--Project support; 11--Project operator positions; 12--Program of studies; 13--Main point 1; 14--Main point 2; 15--Main point 3; 16--Main point 4; 17--Main point 5; 18--Main point 6; 19--Main point 7; 20--Main point 8; 21--Plus non-R&D-related costs; 22--Total costs; 23--Execution of project operater positions (individual costs); 24--Execution of project-promoted tasks (individual costs); 25--Depreciation; 26--Amendment position operation; 27--Estimate for operating fund plan plus estimate for investment fund plan; 28--Economic plan estimate, total; 29--In-house earnings; 30--Subsidy requirement, total; 31--Including; 32--German Federal States.

DFVLR Research and Service Installations--As of December 1982

Flight Mechanics and Flight Control Research Area

(11100) Flight Mechanics Institute, Braunschweig
(11200) Flight Control Institute, Braunschweig
(31600) Aviation Medicine Institute, Cologne-Porz
(31700) Air Traffic Science Division, Cologne-Porz (1)
(51500) Institute of Flight System Dynamics, Oberpfaffenhofen

Fluid Mechanics Research Area

(12800) Technical Acoustics Division, Braunschweig (2)
(12900) Aerodynamic Design Institute, Braunschweig
(22100) Theoretical Fluid Mechanics Institute, Goettingen
(22200) Experimental Fluid Mechanics Institute, Goettingen (Goettingen, Berlin, Cologne-Porz)
(32500) Propulsion Engineering Institute, Cologne-Porz

Working Materials and Construction Method Research Area

(13100) Structural Mechanics Institute, Braunschweig
(23200) Aeroelastics Institute, Goettingen
(33300) Space Simulation Institute, Cologne-Porz
(33400) Work Material Research Institute, Cologne-Porz
(43500) Construction Method and Design Research Institute, Stuttgart

Energy Research Area

(44100) Engineering Physics Institute, Stuttgart
(44200) Physical Chemistry of Combustion Institute, Stuttgart
(64300) Chemical Propulsion and Process Engineering Institute, Lampoldshausen

Communications Technology and Reconnaissance Research Area

(55100) High-Frequency Engineering Institute, Oberpfaffenhofen
(55200) Optical Electronics Institute, Oberpfaffenhofen
(55300) Physics of the Atmosphere Institute, Oberpfaffenhofen
(55400) Communications Engineering Institute, Oberpfaffenhofen

Scientific-Technical Operating Installations Area

(36600) Library Division, Cologne-Porz
(Braunschweig, Goettingen, Cologne-Porz, Stuttgart, Oberpfaffenhofen)
(56200) Main Division for Central Data Processing, Oberpfaffenhofen
(Braunschweig, Goettingen, Cologne-Porz, Stuttgart, Oberpfaffenhofen)
(56300) Main Division for Flight Operations, Oberpfaffenhofen
(Braunschweig, Oberpfaffenhofen)
(56400) Main Division for Space Flight Missions, Oberpfaffenhofen
(56500) Main Division for Applied Data Technology, Oberpfaffenhofen

Wind Tunnels Main Division, Goettingen (29100 (Braunschweig, Goettingen, Cologne-Porz)

Project Operator Position Area

(37100) Main Division for Space Research, Cologne-Porz
(37200) Main Division for Communications Systems, Cologne-Porz
(37300) Main Division for Space Flight Technology, Cologne-Porz
(37400) Main Division for Shuttle and Spacelab Use, Cologne-Porz
(37500) Main Division for New Technologies, Cologne-Porz
(37700) Space Program Support Main Division, Cologne-Porz
(37800) Energy Engineering Projects Main Division, Cologne-Porz
(37900) ATTAS Project Bureau, Cologne-Porz

Humanization of Work Life Project Operator Position, Bonn-Bad Godesberg (37600)

Technical Services Area

(38100) Technical Operations Main Division, Cologne-Porz
(38300) Construction Administration Main Division, Cologne-Porz

(1) Integration into the project operator position area intended; (2) As of 1 January 1983, integration into the Aerodynamic Design Institute.

[pp 10-4--10-5]

DFVLR Infrastructure

Organization of Infrastructure

Administration and General Services

Main Division for Personnel
Main Division for Finance
Main Division for Law and Contracts
Main Division for Procurement
Main Division for General Services
Main Division for Administration, Braunschweig
Main Division for Administration, Goettingen
Main Division for Administration, Stuttgart
Main Division for Administration, Oberpfaffenhofen

Board of Directors and Staff

Board of Directors

Board of Directors Office Staff Division
Outside Relations
Publicity Work and Press
In-House Review [Audit]
Scientific Reporting
ZFW Editorial Board

Program Preparation Staff Division

Central Program Coordination Staff Division

Medium-Term Development

		Ist 1981	Soll 1982	**Soll 1983**	Soll 1984	Soll 1985	Soll 1986
1	**Kosten in Mio DM**						
2	Verwaltung/Allgemeine Dienste	25,5	26,5	**27,6**	28,7	29,9	31,1
3	Vorstand/Stab	18,8	19,6	**20,4**	21,2	22,0	22,9
4	Σ Infrastruktur	44,3	46,1	**48,0**	49,9	51,9	54,0

		Ist 1981	Soll 1982	**Soll 1983**	Soll 1984	Soll 1985	Soll 1986
5	**Personalkapazität in Mannjahren**						
2	Verwaltung/Allgemeine Dienste	454	454	**451**	446	438	438
3	Vorstand/Stab	119	110	**102**	98	98	98
4	Σ Infrastruktur	573	564	**553**	554	536	536

Key: 1--Costs in millions of DM; 2--Administration, general services; 3--Board of Directors, staff; 4--Σ infrastructure; 5--Personnel capacity in man-years; Ist--Actual; Soll--Required.

Total Costs

		Ist 1981	Soll 1982	**Soll 1983**	Soll 1984	Soll 1985	Soll 1986
1	**Gesamtkosten in Mio DM**						
	Σ	328,4	358,3	**369,1**	390,4	410,6	438,2

Key: 1--Total costs in millions of DM; Ist--Actual; Soll--Required.

Transition into 1983 Economic Plan

1 Angaben in Mio DM

2 Überleitungsrechnung vom Programmbudget zum Wirtschaftsplan	3 DFVLR Gesamt 1983	4 davon Durchführung	
		5 von der Wehrtechnik initiierte Forschung und Entwicklung	6 Projektträgerschaften und projektgeförderte Aufgaben
7 Gesamtkosten	369,1	62,9	44,1
8 – Durchführung von Projektträgerschaften (Einzelkosten)	26,2	–	26,2
9 – Durchführung von projektgeförderten Aufgaben (Einzelkosten)	12,5	–	12,5
10 – Abschreibungen	37,2	8,1	–
11 – Veränderungs-Position Betrieb	0,3	–	–
12 Ansatz Betriebsmittelplan	292,9	54,8	5,4
13 + Ansatz Investitionsplan	51,5	8,2	–
14 Wirtschaftsplanansatz			
15 Gesamt	344,4	63,0	5,4
16 + Eigene Erträge	49,0	2,8	5,4
17 Zuwendungsbedarf			
15 Gesamt	**295,4**	**60,2**	–
18 davon BMFT	211,7	–	–
19 davon BMVg	56,2	56,2	–
20 davon Länder	27,5	4,0	–

Key: 1--Expenditures in millions of DM; 2--Transfer calculation from program budget to economic plan; 3--Total; 4--Including execution; 5--Research and development initiated by military technology; 6--Project operator positions and project-promoted tasks; 7--Total costs; 8--Execution of project operator position (individual costs); 9--Execution of project-promoted task (individual costs); 10--Depreciation; 11--Amend position operation; 12--Estimate of operating fund plan; 13--Plus estimate of investment plan; 14--Economic plan estimate; 15--Total; 16--Plus in-house earnings; 17--Subsidy requirement; 18--Including BMFT; 19--Including BMVg; 20--Including German Federal States.

DFVLR Finance Plan

1	Zuwendungsbedarf in Mio DM	1981	1982	1983	1984	1985	1986
	Σ	267,8	285,0	295,4	318,8	337,0	359,4

Key: 1--Subsidy requirement in millions of DM.

5058
CSO: 3698/449

END